

REMARKS

Claims 1, 3 and 5 have been amended and claims 1-11 and 18-26 remain pending in this application. No new matter has been added by this amendment. Applicant respectfully requests reconsideration of the pending claims in view of the above amendments and the following remarks.

Claims 1 and 3 have been rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The language for which support was allegedly lacking has been removed from the claims. Applicant submits that the rejection of the claims under these grounds is moot.

Claims 1-6, 9-11, 18-21, 23 and 25 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,502,205 to Yanai et al. (hereinafter “Yanai”). This rejection is respectfully traversed.

As previously described, it is known to mirror data from a local disk to a remote disk, to provide some redundancy in the event of a failure of the local disk. One problem with existing systems is that they use specialized hardware and customized communication infrastructure. Another problem is that they use schemes that seek to render remote disk updates more efficient by reducing the amount of data that needs to be sent to the remote storage system. These schemes tend to introduce a loss of information, particularly where individual write transactions are supplanted by subsequent write transactions to the same location.

Applicant’s invention offers mirroring at a remote storage device by intercepting I/O transactions to a storage disk of a local storage system, retaining and encapsulating write transactions in a series of local file system files, and transmitting such files to the remote storage

system via a non-proprietary network protocol. This provides several advantages not believed to be present in conventional systems. First, it does not introduce delays because it does not make local storage operations dependent upon completion at the remote location. It also retains a full transaction level record of write transactions that allows a return to any point on a per-transaction basis in the event of failure on either the local or remote storage side. Finally, it performs these tasks using standard file system files and non-proprietary network communication protocols (e.g., IP and/or FTP), which introduces flexibility and resiliency to the system.

For example, claim 1 recites *[a] A system for mirroring write operations from a local storage system onto a remote storage system, the system comprising: an asynchronous mirroring driver resident in the local storage system for intercepting I/O transactions to a storage disk of the local storage system, identifying a series of write transactions issued to said storage disk, making a copy of the series of write transactions, and storing said copy in at least one of a series of files that are created on a file-system of the local storage system; and a first asynchronous mirroring coordinator resident on the local storage system for invoking a file transfer system to transmit the series of files on the local file-system of the local storage system to a file system of the remote storage system via a non-proprietary network protocol to accommodate an exact reproduction at the remote storage system of the series of write transactions as issued to said storage disk of the local storage system.*

These claimed features are neither disclosed nor suggested by Yanai, which discloses a remote data mirroring system that implements dedicated disk adapters and a high speed proprietary communications protocol to seek provision of high bandwidth mirroring of data.

While certain features in Yanai may be useful for mirroring a host system storage resource without imposing undue performance degradation, Yanai is devoid of any disclosure or suggestion of various features of Applicant's claimed invention. For example, Yanai does not

retain a series of write transactions as issued to the local storage disk, nor does Yanai retain the series of write transactions in file system based files. Instead, Yanai generally manages the reconciliation of the primary and remote storage devices by maintaining an index or list of various criteria including which data has been mirrored. (Yanai, 10:59-11:10). Particularly, Yanai implements an index of tracks to organize the pendency of writes on the primary and remote storage systems via the inclusion of flags that are set and reset to indicate whether a write is pending or completed. (Yanai, 10:11-43).

Applicant's claimed invention stores the series of write transactions in file system files. This retains the record of write transactions on a per-transaction basis, which allows a return to any point in the series of write transactions. Additionally, the return to any point in the series of write transactions may be made not only on the remote storage side, but also on the local storage disk.

There are various modes of operation in Yanai, including synchronous and semi-synchronous, as well as an adaptive copy mode that does not wait for receipt acknowledgement or synchronization to occur as noted above. (Yanai, 19:65-20:64). Regardless of the mode of operation, Yanai still fails to disclose or suggest retention of the series of write transactions in file system based files as claimed by Applicant. Yanai instead uses the above-described indices in conjunction with a cache that stores data to be written to disks in all modes of operation. There is no disclosure or suggestion of file system files that retain a copy of the series of write transactions as issued for the local storage disk, as claimed by Applicant.

There are other claimed features that are absent from Yanai, including transmission of the above-described files via a non-proprietary network. Yanai appears to use a dedicated link and proprietary protocols in the link between the primary and the secondary storage systems. By

contrast, Applicant's claimed file system files are configured to allow them to be transmitted over a non-proprietary network protocol. For example, an Internet connection may be used to transfer files from the local storage system to the remote storage system. There is no need for expensive, proprietary communication links with Applicant's claimed invention, as the write transactions are retained in file system files that are easily transferred between systems.

Finally, the retained series of write transactions accommodates an exact reproduction of the series write transactions at the remote storage system, just as they had been issued at the local storage system. In contrast, indexing schemes merely seek to reconcile the two systems, with some loss of the transaction record. Applicant's claimed invention provides a retention of the series of write transactions on a per-transaction basis, and does so using file system based files. These features are also clearly absent from Yanai.

Since Yanai is devoid of any disclosure or suggestion of various features recited in claim 1 (and, for similar reasons, independent claims 3 and 5), Applicant respectfully requests reconsideration and withdrawal of the rejection of those claims.

Applicant also submits that dependent claims 2, 4, 6, 9-11 and 18-26 are distinct from Yanai for incorporating the features of their respective independent claims, and for the features separately recited therein.

Particularly, claims 2, 4 and 6 variously recite receipt of the series of write transactions at the remote storage system, and corresponding issuance of the write transactions to the remote storage device. With the above-described features of retention of the series of write transactions as issued to the local storage device, this furthers an exact reproduction of the series of write transactions on the remote storage system, which is not disclosed or suggested by Yanai.

Additionally, claims 21, 23 and 25 recite pointers between the files for sequencing the write transactions. The passages in Yanai cited by the Examiner reference the tables and indices used to reconcile data found on the local and remote storage systems on a track basis and in no way disclose or suggest the files, series of write transactions, or file pointers claimed by Applicant.

Accordingly, Applicant requests reconsideration and withdrawal of the rejection of claims 1-6, 9-11, and 18-26 under 35 U.S.C. § 102.

Claims 7 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Yanai in view of U.S. Patent No. 5,673,382 to Cannon et al. (hereinafter “Cannon”), and claim 8 has been rejected as being unpatentable over Ohran in view of Cannon and U.S. Patent No. 5,713,014 to Durflinger et al. (“Durflinger”). These rejections are respectfully traversed.

Claims 7 and 8 incorporate the features of claim 1 and are neither disclosed nor suggested by Yanai, Durflinger and Cannon, taken alone or in combination, for the reasons set forth in detail above. Particularly, Yanai (and Durflinger and Cannon) fail to disclose or suggest retention of the claimed series of write transactions, in file system based files, with corresponding non-proprietary transmission and reproduction of the series of write transactions on the remote storage system as claimed by Applicant. Moreover, claims 7 and 8 add features found in the files that contain the above content. Since even the basic elements of such files are not found in the cited references, clearly there is also a failure to disclose the particulars recited in claims 7 and 8.

Additionally, as indicated in the previous response, the Cannon and Durflinger references do not include the features found in claims 7 and 8. As noted previously, Cannon appears to describe locating a file by noting its offset within a storage volume. (Cannon, 8:41-46). This

does not disclose the presentation of a write transaction in a file, and corresponding inclusion of the size of the file itself, or offset information as claimed. Durflinger discloses a database management system and uses pointers to locate data positions within files, and clearly does so well outside the context of Applicant's claimed invention.

Applicant submits that the introduction of these references is an improper attempt at a reconstruction of Applicant's claimed invention in hindsight, and notes that despite the impropriety of the offered combination, the effort still fails to yield Applicant's claimed invention.

Accordingly, Applicant requests reconsideration and withdrawal of the rejection of claims 7-8 under 35 U.S.C. § 103.

For the foregoing reasons, Applicant requests reconsideration and withdrawal of the rejection of claims, and allowance of the claims that remain pending in the application.

Should the Examiner believe that anything further is desirable to place the application in condition for allowance, the Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below.

Respectfully Submitted,



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